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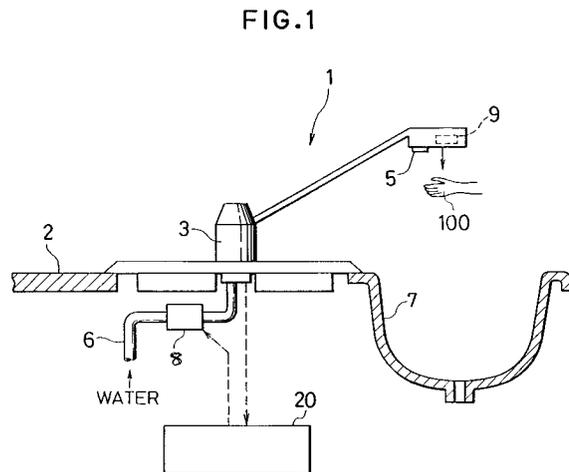
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Automatic faucet system.

An automatic faucet system for automatically discharging water from a discharge opening (5) provided at the end of a discharge opening pipe by moving a valve (8) associated with a faucet (3) by driving by a drive controller (20) when a sensor (9) detects an object. The ultrasonic sensor for detecting the object is a Doppler effect type sensor comprising an oscillator (10) for oscillating ultrasound of a predetermined frequency and a receiver (11) for receiving the ultrasound reflected by the object and detecting that the object is a moving body when a difference is generated between the frequency of the ultrasound oscillated from the oscillator and that of the ultrasound received by the receiver.



The present invention relates to an automatic faucet system for automatically discharging water from a discharge opening provided at an end of a discharge pipe by detecting a hand or the like by a sensor and more particularly to an automatic faucet system for detecting a hand or the like by ultrasound.

Conventionally, an automatic faucet system is used for washing hands or the like by automatically discharging water from a discharge opening when ultrasound transmitted from an oscillator of an ultrasonic sensor which is disposed near the discharge opening is reflected by an object such as a hand and is received by a receiver.

The conventional ultrasonic sensor measures the time interval from when ultrasound is transmitted from the oscillator to it being received by the receiver, and the sensor computes a distance to the object based on such time. When the distance changes in a short time, it judges that the object is moving, whereby it opens an electromagnetic valve or the like by a drive controller to discharge water automatically from the discharge opening provided at the end of the discharge opening pipe.

However, the ultrasonic sensor used for such prior art automatic faucet system has a problem in that water may be discharged from the discharge opening even when an object such as a hand is not stretched out due to a so-called crosstalk phenomenon, i.e. ultrasound transmitted from the oscillator may be directly received by the receiver.

It is an object of the present invention to provide an automatic faucet system which is highly reliable and causes no erroneous operation.

According to the present invention there is provided a system for automatically discharging water by detecting an object near a discharge opening, comprising: detecting means for detecting a said object near said discharge opening, said detecting means having outputting means for transmitting ultrasound and receiving means for receiving ultrasound reflected back by a said object; and water supplying means including valve means for supplying water to said discharge opening when said detecting means detects said object; said detecting means further having means for comparing a frequency f_1 of the output ultrasound and a frequency f_2 of the received ultrasound and for outputting a valve opening signal when the received frequency f_2 is greater than the output frequency f_1 due to Doppler effect caused by approaching movement of said object.

Thus, the sensor for detecting an object detects the object as a moving body and outputs a detection signal when a difference is generated between the frequency of the ultrasound transmitted from the oscillator and that of the ultrasound received by the receiver, so that a valve associated with the faucet is operated by being driven by a drive controller into which the detection signal is input and water is dis-

charged to the object from the discharge opening provided at the end of the discharge opening pipe. The ultrasonic sensor utilizes Doppler effect and detects an object to be a moving body only when a frequency of ultrasound received differs from that of ultrasound transmitted. It ignores the received ultrasound when a crosstalk phenomenon occurs, i.e. when the frequency of the received ultrasound is the same with that of the oscillated ultrasound.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:-

Fig. 1 is a sectional view illustrating a system of a preferred embodiment of the present invention; Fig. 2 is a block diagram showing a structure of the system of the preferred embodiment; and Fig. 3 is a flow chart showing operations of the system of the preferred embodiment.

A discharge opening 5 is provided on a main body of the faucet 3 provided on a washstand 2. A water supply pipe 6, having an electromagnetic valve 8, is connected to the lower part of the main body of the faucet 3. The reference numeral 7 denotes a wash basin.

An ultrasonic sensor 9 for detecting a hand 100 stretched out is provided near the discharge opening 5. The ultrasonic sensor 9 is one utilizing Doppler effect constructed as shown in Fig. 2 so that it can detect the hand only when the hand 100 is moved.

The ultrasonic sensor 9 comprises a speaker 10 for oscillating and outputting ultrasound, a microphone 11 for receiving the ultrasound transmitted from the speaker 10 and reflected by the hand 100 and for converting and outputting the received ultrasound as an electrical signal, an oscillating circuit 12 for outputting an oscillating electric signal of frequency f_1 (Hz) which is equal to that of the ultrasound transmitted from the speaker 10, a filter circuit 13 for passing the electric signal from the microphone 11 when a difference which exceeds a predetermined frequency is generated between the frequency f_2 of the received signal of the receiver 11 and the frequency f_1 , i.e. when Doppler effect occurs, and an amplifier 14 for amplifying and outputting the electrical signal that passes through the filter circuit 13.

Due to the Doppler effect, the frequency f_2 of the received ultrasound is higher than the frequency f_1 of the transmitted ultrasound when the hand 100 approaches the microphone 11 and contrary to that, the frequency f_2 of the received ultrasound is lower than the frequency f_1 of the transmitted ultrasound when the hand 100 recedes from the microphone 11.

Accordingly, as shown in Fig. 3, when the hand 100 moves in the direction approaching to the sensor 9, f_2 becomes greater than f_1 , thereby the received signal being output to the amplifier 14 through the filter circuit 13.

When the electrical signal output from the ampli-

fier 14 is input to a drive controller 20, the electromagnetic valve 8 is opened by the signal from the drive controller 20 and water is discharged from the discharge opening 5.

After opening the valve, the sensor 9 monitors whether the hand 100 is continuously detected. That is, if the hand 100 is detected and $f2 \geq f1$, water is continuously discharged. However, if the hand 100 cannot be detected, the valve is closed. When $f2 < f1$ even if the hand is detected, the valve is closed because it means that the hand is receding from the discharge opening.

In this faucet, even if a crosstalk phenomenon in which ultrasound from the speaker 10 is directly received by the receiver 11 occurs, since the frequency $f2$ of the received ultrasound is equal to that of the oscillated ultrasound $f1$, the electrical signal output from the microphone 11 cannot pass through the filter circuit 13. Accordingly, no erroneous detection due to a crosstalk phenomenon will take place by the sensor 9 of the present invention.

cy $f1$ and passing the received signal when $f2$ is greater than $f1$ and when $f2$ is smaller than $f1$.

- 5. The system according to claim 4, wherein said detecting means has an amplifier for amplifying the signal passed through said circuit means and outputting the amplified signal to said water supplying means.

Claims

1. A system for automatically discharging water by detecting an object near a discharge opening, comprising: detecting means for detecting a said object near said discharge opening, said detecting means having outputting means for transmitting ultrasound and receiving means for receiving ultrasound reflected back by a said object; and water supplying means including valve means for supplying water to said discharge opening when said detecting means detects said object; said detecting means further having means for comparing a frequency $f1$ of the output ultrasound and a frequency $f2$ of the received ultrasound and for outputting a valve opening signal when the received frequency $f2$ is greater than the output frequency $f1$ due to Doppler effect caused by approaching movement of said object.

2. The system according to claim 1, wherein said valve means is continued to be opened when said detecting means detects the reflected ultrasound after opening said valve means.

3. The system according to claim 1 or 2, wherein said detecting means has means for outputting a valve closing signal when the received frequency $f2$ becomes smaller than the output frequency $f1$ due to the Doppler effect caused by receding movement of said object.

4. The system according to claim 3, wherein said detecting means has a circuit means for comparing the received frequency $f2$ and the output frequen-

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FIG.1

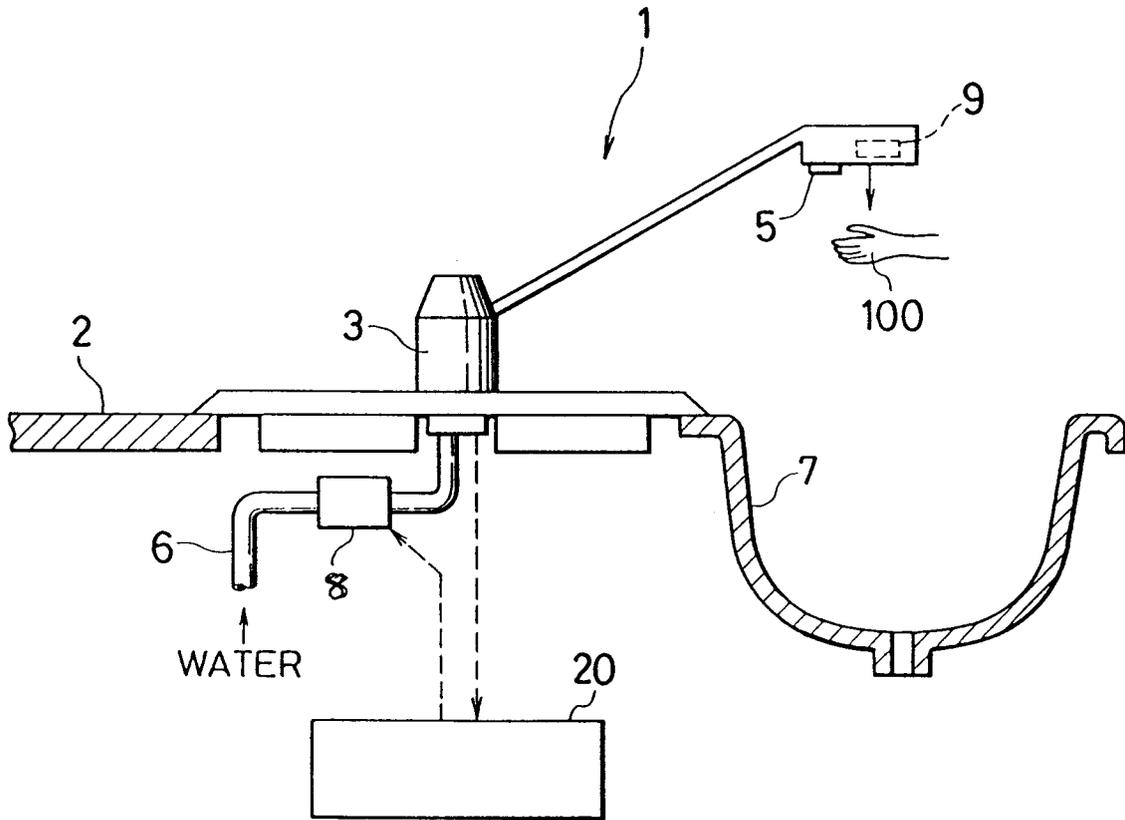


FIG.2

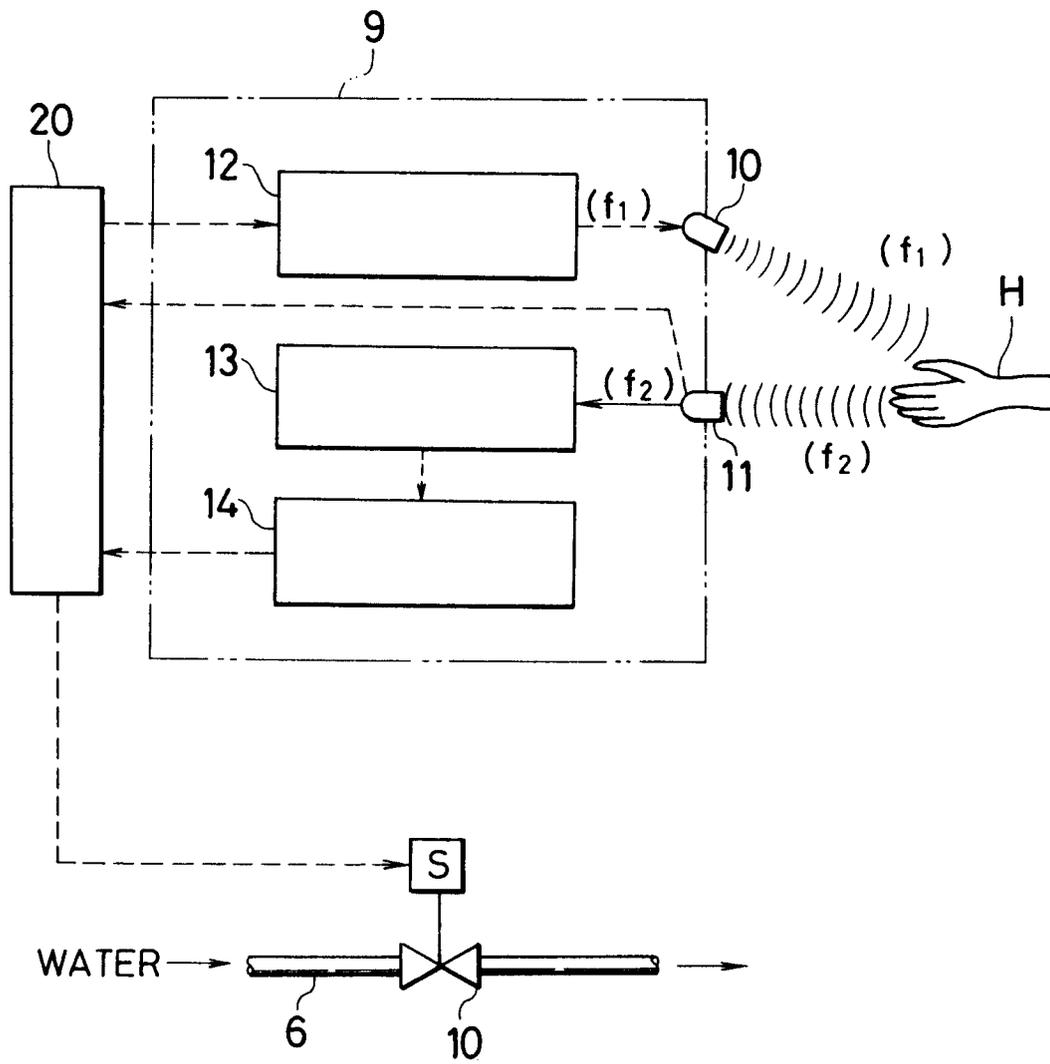
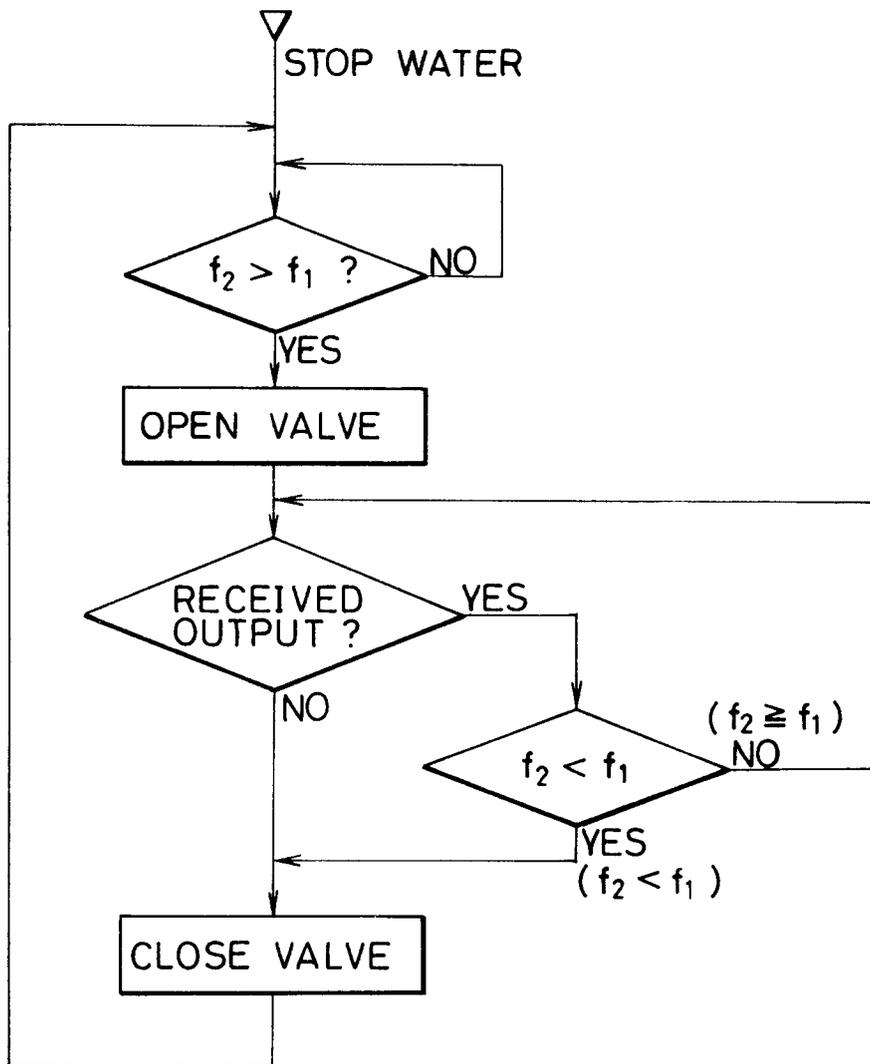


FIG.3





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 31 1779

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-B-2 034 877 (VISOLUX-ELEKTRONIC RICHARD SIERING GMBH)	1	E03C1/05
Y	* the whole document *	2	
A	---	3-5	
X	FR-A-2 390 653 (SIEMENS A.G.)	1	
A	* page 2, paragraph 2 -paragraph 3 *	2-5	
Y	WO-A-8 501 337 (PARSONS)	2	
A	* page 13, line 13 - page 14, line 21; claim 3 *	1,3-5	
A	WO-A-8 705 352 (RECURRENT SOLUTIONS LTD PARTNERSHIP)		

The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E03C
Place of search		Date of completion of the search	Examiner
THE HAGUE		07 APRIL 1993	VAN BEURDEN J.J.C.A
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone		T : theory or principle underlying the invention	
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